

Remarks

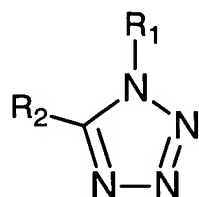
The present application includes claims 1-12, 21 and 22. Claims 1-3, 10, 12 and 21-22 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Ferrier (6,162,503) in view of Yamada (JP 11029883). Claims 4-8 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Ferrier in view of Yamada and further in view of Adlam (5,861,076). Claim 9 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Ferrier in view of Yamada and further in view of Noddin (5,910,255). Claim 11 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Ferrier in view of Yamada and further in view of Bishop (6,284,309).

The Applicants are perplexed because the current Office Action presents a rejection over the Ferrier reference that is substantially the same as a rejection that was first made in this Application in an Office Action dated May 14, 2003 (over three years ago). Applicants overcame that rejection by submitting a Rule 132 Declaration by Applicant Roger Bernards. The Office Action dated June 24, 2004 acknowledged as much: "The declaration under 37 CFR 1.132 filed 4/13/04 is sufficient to overcome the rejection of claims 1-12 based on Ferrier (6,162,503)" (Page 2.)

As is explained below, the Rule 132 declaration by Roger Bernards supports the nonobviousness of Applicants' claims over the Ferrier reference for the same reasons that were explained in September 2003. Applicants respectfully urge the Examiner accept the submitted evidence and issue a Notice of Allowability for pending claims 1-12, 21 and 22.

35 U.S.C. § 103 (Non-obviousness) – Ferrier in view of Yamada

Applicants turn to the rejection of claims 1-3, 10, 12, and 21-22 as being unpatentable under 35 U.S.C. 103(a) over Ferrier in view of Yamada. Claim 1 recites a process for preparing a roughened copper surface which involves the step of contacting a copper surface with an adhesion promoting composition. The adhesion promoting composition of claim 1 contains hydrogen peroxide, a pH adjuster (an acid), a 5-membered aromatic fused N-heterocyclic ring compound where the N-heterocyclic ring has a nitrogen atom at position 1 bonded to a hydrogen atom, and a uniformity enhancer having the formula:



Formula (I)

wherein R1 and R2 are independently selected from hydrogen or hydroxyl, amino, alkyl, hydroxyalkyl, aminoalkyl, nitroalkyl, mercaptoalkyl, or alkoxy groups. Applicants discovered that this unique combination led to the formation of a uniformly coated and roughened surface.

Ferrier '503 also teaches the application of an adhesion promoting composition to a copper surface. The composition of Ferrier '503 contains an oxidizer, an acid, a "corrosion inhibitor," and a benzotriazole with an electron withdrawing group in the 1 position which group is a stronger electron withdrawer than a hydrogen group. Applicants first note that Applicants have not claimed "a benzotriazole with an electron withdrawing group in the 1 position which group is a stronger electron withdrawer than a hydrogen group." While Applicants recite a 5-membered aromatic fused N-heterocyclic ring compound (which

includes benzotriazole), it is specified that the N-heterocyclic ring ***has a nitrogen atom at position 1 bonded to a hydrogen atom***. This language specifically excludes the benzotriazole of Ferrier, which requires something other than a hydrogen atom to be in “the 1 position.” So this component disclosed in Ferrier is not relevant to Applicants’ claimed subject matter.

The remaining components of Ferrier’s adhesion promoting composition are: an oxidizer, an acid, and a “corrosion inhibitor.” The specification of Ferrier ‘503 states that “[p]referred corrosion inhibitors are selected from the group consisting of triazoles, benzotriazoles, tetrazoles, imidazoles, benzimidazoles and mixtures of the foregoing.” Col. 5, lines 32-36. The position taken in the Office action appears to be that the corrosion inhibitor of Ferrier ‘503 could be a “mixture” of a benzotriazole (which could, if it was 1H-benzotriazole, serve as Applicants’ claimed 5-membered aromatic fused N-heterocyclic ring compound) and a tetrazole (a “uniformity enhancer” according to formula (I)). In other words, since the specification of Ferrier ‘503 uses the language “mixtures of the foregoing,” it would be obvious to one of ordinary skill in the art to make the particular combination of a 1H-benzotriazole with a tetrazole, thereby arriving at the adhesion promoting composition used in applicants’ inventive process.

Applicants submit that a skilled artisan would not find it obvious from the teachings of Ferrier ‘503 to select a corrosion inhibitor that is a mixture of a benzotriazole with a tetrazole according to formula (I). There is nothing in the specification of Ferrier ‘503 to suggest that such a combination would have any particular benefit. None of the examples in Ferrier ‘503 make use of a mixture of a benzotriazole with a tetrazole according to formula (I). In fact, no tetrazole is used in any example of Ferrier ‘503. The focus of

Ferrier '503 is instead on additional components that are added to the adhesion promoting composition to improve adhesiveness, in particular, the benzotriazole with an electron withdrawing group in the 1-position (referred to above) and "adhesion enhancing species" (molybdates, tungstates, etc.). Col. 5, line 40 through col. 6, line 34.

Nor does the Yamada reference suggest the beneficial combination discovered by Applicants. Yamada, which is supplied as teaching a specific derivative of tetrazole claimed by Applicants (5-aminotetrazole) in a copper surface roughening solution, does not even mention the use of a 5-membered aromatic fused N-heterocyclic ring compound where the N-heterocyclic ring has a nitrogen atom at position 1 bonded to a hydrogen atom (such as 1H-benzotriazole). At best, if combined with Ferrier, Yamada might suggest the use of a tetrazole such as 5-aminotetrazole as the "corrosion inhibitor" of Ferrier. But Yamada, either by itself or combined with Ferrier, in no way suggests the use of a tetrazole *in combination with* 1H-benzotriazole in an adhesion promoting composition. Nor does Yamada suggest that there would be any benefit to such a combination.

Applicants, on the other hand, discovered that there is an unexpected benefit to adding a compound falling within formula (I)—a tetrazole—to an adhesion promoting composition which contains hydrogen peroxide, a pH adjuster and 1H-benzotriazole. In particular, the use of a tetrazole falling within formula (I) leads to a more uniformly etched copper surface. In order to overcome a previous rejection based on the Ferrier (6,162,503) patent, Applicants submitted a declaration of Applicant Roger Bernards which describes the unexpected and unique nature of this discovery. Applicants have resubmitted, simultaneously with this Amendment, Mr. Bernards' declaration as evidence

of the nonobviousness of claims 1-3, 12 and 21 over Ferrier, either alone or as considered in view of Yamada. (See enclosed copy of Declaration Under Rule 132 dated September 9, 2003.)

As Mr. Bernards explains in his declaration, he conducted several experiments comparing an adhesion promoting composition that contained a tetrazole with an adhesion promoting composition that did not contain a tetrazole. Bernards Dec. ¶ 4. These experiments are described as Examples 1-3 in the patent application. Bernards Dec. ¶ 4. In Examples 1 and 2, Mr. Bernards used an adhesion promoting composition that contained hydrogen peroxide, a pH adjuster (sulfuric acid), and a 5-membered aromatic fused N-heterocyclic ring compound where the N-heterocyclic ring has a nitrogen atom at position 1 bonded to a hydrogen atom (benzotriazole), but which did not contain a tetrazole. Bernards Dec. ¶¶ 5-6, 8; specification, page 19.

When applied to a copper surface, the composition of Example 1 both etched and modified the surface. However, the etched surface was undesirably speckled with shiny spots of copper, indicating a non-uniform etch. Bernards Dec. ¶ 7. Similarly, the composition of Example 2 both etched and modified the copper surface, but the etched surface developed undesirable striations that were indicative of a non-uniform etch. Bernards Dec. ¶ 8.

Mr. Bernards used a tetrazole falling within formula (I) in Example 3. In particular, he applied the following composition to a copper surface: 3% hydrogen peroxide, 5% sulfuric acid, 1.5 g/l benzotriazole, 0.5 g/l **5-Aminotetrazole**, and the balance deionized water. This tetrazole-containing adhesion promoting composition both etched and modified the copper surface. Unlike Examples 1 and 2 however, the

etched surface was desirably uniformly etched. Bernards Dec. ¶ 9. These same results are provided in the specification of the Application. See page 17, Examples 1-3 and Table 1 on page 19.

Mr. Bernards was surprised by this result. Bernards Dec. ¶ 10. He did not expect that the addition of a tetrazole would lead to a uniformly etched surface. Bernards Dec. ¶ 10. In fact, at the time Mr. Bernards and his co-inventors filed the application, tetrazoles were not known in the art as compounds which can improve the uniformity of a controlled etch. Bernards Dec. ¶ 10. As a result of their discovery, Applicants called the tetrazole component of their adhesion promoting composition a “uniformity enhancer.” Bernards Dec. ¶ 10.

Thus, Mr. Bernards discovered during the course of his experimentation that the particular combination of an oxidizer (hydrogen peroxide), a pH adjuster, a 5-membered aromatic fused N-heterocyclic ring compound where the N-heterocyclic ring has a nitrogen atom at position 1 bonded to a hydrogen atom, and a uniformity enhancer falling within formula (I) (the tetrazole) leads to the unexpected and beneficial result of a uniformly etched surface. Bernards Dec. ¶ 11. Nothing in Ferrier or Yamada would lead a person of ordinary skill in the art to expect the particular benefit of this combination. Specifically, nothing in Ferrier (whether in combination with Yamada or not) would lead a person of ordinary skill in the art to expect this particular benefit if he or she were to combine 1H-benzotriazole with a tetrazole as the “corrosion inhibitor” for that reference. For this reason, Applicants submit that it would not be obvious from the teachings of Ferrier and/or Yamada to make the particular combination of compounds that would result in the Applicants’ claimed subject matter.

A showing of unexpected results supports the nonobviousness of a claimed invention. Thus, applicants submit that rejected claims 1-3, 10, 12 and 21-22 are not obvious, and respectfully request that the Examiner acknowledge their allowability.

Other Obviousness Rejections

The other obviousness rejections in the April 17, 2006 Office Action pertain to claims 4-9 and 11, all of which depend, either directly or indirectly, from claim 1. Because claim 1, as amended, has been shown above to be patentable, Applicants submit that claims 4-8, 9 and 11 are patentable as dependent on an allowable base claim. Nonetheless, Applicants traverse these obviousness rejections for at least the following reasons:

1. A skilled artisan would not find it obvious to combine the teachings of Ferrier with Adlam to arrive at the post-dip step that is recited in applicants' claims. Adlam pertains to a more traditional black oxide coating process, whereas Ferrier pertains to an alternative oxide process in which the copper surface is both etched and modified.

2. A skilled artisan would not find it obvious to combine the teachings of Ferrier with Bishop to arrive at the supplemental use of a copper salt that is recited in applicants' claim 11. Bishop makes use of a copper complex to ostensibly promote adhesion. However, the copper complex of Bishop is always used in conjunction with a "copper complexing agent." See Col. 4, lines 2-3. By inference, the copper complex and the copper complexing agent of Bishop work in conjunction to achieve the desired adhesion characteristics, which apparently involves precipitating copper from the solution onto the copper surface. By way of distinction, it is submitted that the

composition of Ferrier primarily etches, or **removes**, copper from the surface rather than precipitating additional copper onto the surface.

Conclusion

The applicant has shown, through the remarks above and the re-submission of evidence in the form of Roger Bernards Rule 132 declaration, that this application satisfies all the legal requirements pointed out by the Examiner. Therefore, the Examiner is respectfully requested to prepare a Notice of Allowability allowing all the pending claims 1-12 and 21-22.

If the Examiner has any questions or the Applicants can be of any assistance, the Examiner is invited and encouraged to contact the Applicants at the number below.

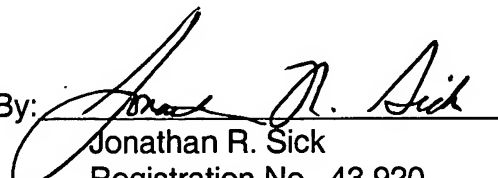
The Commissioner is authorized to charge any necessary fees or credit any overpayment to the Deposit Account of McAndrews, Held & Malloy, Account No. 13-0017.

Respectfully submitted,

McANDREWS, HELD & MALLOY, LTD.

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